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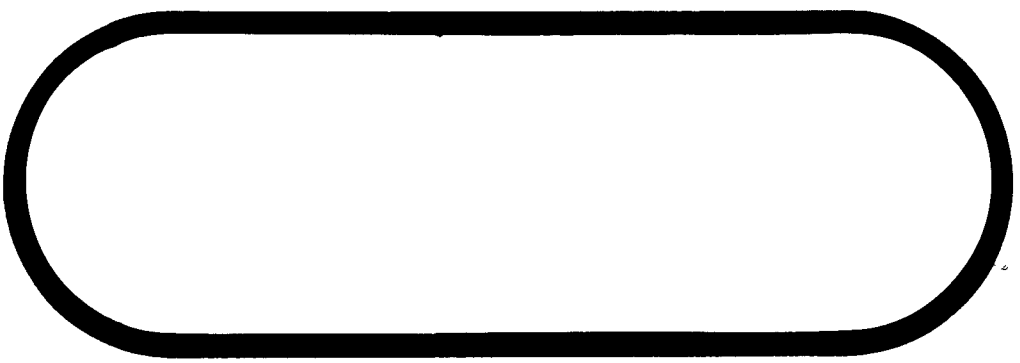

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THE BOEING COMPANY

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MODEL NO. HSM 80C CONTRACT NO. AF04(694)-266

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ACTIVE PAGE RECORD

SECTION	ORIG REL PAGE NO.	REV SYM	ADDED PAGES					
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	6							
	7							
C	8	B						

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
A	Added Section C to define the test program plan for the R&D Instrumentation Subsystem. Changed document title to be consistent with addition of Section C. In Section A Added page 4.1 Revised pages 1, 2, 3 In Section B Revised page 1 In Section C Added pages 1, 2, 3, 4, 5, 6, 7, 8, 9, 10	1-17-3	
B	Completely revised to update and complete the engineering test program plan. Re-organized document to be consistent with the test categroies as defined in Task 5 of Exhibit B to L/C AF04 (694)-266. Changed document title to include only engineering tests. Deleted "Antenna Patterns and Trajectory Contour Plots" as they are not engineering tests per Exhibit B. Deleted Raceway Seal tests as they are no longer required. In Section A Added pages 19, 20, 21, 22, 23, 24, 25, 26, 27 and 28 Deleted page 4.1 Revised pages 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17 and 18 In Section B Added page 9 Revised pages 1, 2, 3, 4, 5, 6, 7 and 8 In Section C Deleted pages 9 and 10 Revised pages 1, 2, 3, 4, 5, 6, 7 and 8	4-19-3 4-19-63 4-29-63	

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REFERENCES

D2-30069	External Insulation Subsystem Development Plan
D2-30017	Gas Dynamics Test Plan
D2-13493, Vol. III	MISEEL Test Document -- Open End, WS-133B
D2-30154	Electro-Interference Test Plan for the WS-133B Equipment
D2-30155	Electro-Interference Test Objectives for the WS-133B Program -- AMR Complex
D2-30156	Electro-Interference Test Objectives for the WS-133B Program -- PMR Complex
D2-30167	Electro-Interference Test Plan for the WS-133B Program -- AMR Complex
D2-30168	Electro-Interference Test Plan for the WS-133B Program -- PMR Complex
D2-30058	Model Specification for Instrumentation Subsystem Airborne R&D WS-133B (S-133-1007D) U
10-20478	Thermocouple - Reference Junction Assembly for A/B Missiles
10-20472	Connector Assembly - Interstage Breakaway Electrical Test Support Equipment
D2-30218	Detail Test Plan, Section 45, Flight Proof Test (II - III Interstage)
T2-3065	Final Test Report, Section 45, Flight Proof Test (II - III Interstage)
TEDS 31-71/148	Flight Proof and MISEEL Preliminary Test Plans, December 1, 1962
2-6450-02-195	Boeing letter to BSD, dated November 30, 1962, Subject: AV Primary Structure, Secondary Structure and R&D Instrumentation Subsystem Preliminary Design Report.

Minutes of Meeting, WS-133B Airborne Vehicle Secondary Structure and R&D Instrumentation Subsystem Preliminary Design Review,,Meeting No. APO 420, dated January 23 and 24, 1962.

Minutes of Meeting, WS-133B AMR Missile Components, Primary Structure and Raceways Preliminary Design Review Meeting No. 341, dated December 18 and 19, 1962.

Exhibit B to L/C AF04(694)-266, "Statement of Work for IA&T Contractor, Minuteman WS-133B Wing VI Block Change R&D Program (U)", dated January 7, 1962.

PURPOSE

The purpose of this document is to present the complete engineering test program plan for the Boeing supplied AVE for the HSM-80C missile.

SCOPE

This program plan includes the testing on the primary and secondary structures and on the R&D Instrumentation Subsystem. The program plan is divided into three sections; thereby categorizing all engineering tests as experimental, evaluation or special tests to be consistent with Task 5 of the "Statement of Work for Integration, Assembly, and Test Contractor, Minuteman WS-133B Wing VI Block Change R&D Program (U)", dated 7 January 1963, (i.e., Exhibit "B" to L/C AF04(694)-266), hereinafter referred to as "Exhibit B".

This document does not define the contractual requirements for submittal of documentation, e.g. test plans, data reports and final test reports, to BSD for approval. Submittal of test documentation shall be in accordance with Task 5.5 of Exhibit B and as further clarified and agreed to during the WS-133B AMR Missile Primary Structure and Raceway Preliminary Design Review, Meeting Number APO 341, dated December 18 and 19, 1962. Additional requirements for test documentation submittals are subject to further contractual negotiation.

This document does define whether the test documentation is to be formal or informal in nature. Where individual paragraphs of this document specify that formal test documentation will be released, the statement refers only to the internal Boeing Company release procedure, e.g., to engineering files, and does not imply submittal of that documentation to BSD for approval.

All test requirements will be formally documented upon completion of testing and, if not submitted, will be available for review upon request.

AUTHORITY

This document is prepared in partial compliance with Task 3.2.9 of Exhibit B to L/C AF04(694)-266.

1.0 INTRODUCTION, EXPERIMENTAL TESTS

1.1 Purpose

The purpose of this section is to define the program plan for the HSM 80C AVE experimental engineering tests as defined by Task 5.2 of Exhibit B.

1.2 Scope

Experimental tests of Boeing supplied HSM 80C AVE will be performed as considered necessary to support design and analysis activities. These tests will provide data for the experimental verification of proposed designs and design changes. These tests will be conducted on three categories of AVE: Primary and Secondary Structure and the R&D Instrumentation System.

1.2.1 Primary Structure

This phase of the test program is established to develop technical information necessary to:

(a) Determine capabilities of certain Wing I-II structural concepts to meet Wing VI requirements.

(b) Design interstages and skirt structure to meet the HSM 80C requirements.

(c) Demonstrate the structural integrity of the Wing VI interstage and skirt designs.

This program is time phased to support the schedules for design and flight test. Impulse and ordnance joint tests will be completed prior to the Critical Design Review.

Test structures used to demonstrate structural integrity, (Ordnance and Interstage Environmental Vibration, and the fourth Skirt Panel Impulse Test) will be fabricated on production tooling. Development tests (Friction Joint, Ordnance Joint, and the first three Skirt Panel Impulse Tests) will be fabricated in the experimental shops to support schedules.

1.2.2 Secondary Structure

The following experimental tests are required to develop and confirm secondary structure design:

(a) Dynamic investigation of equipment racks - 2-3 interstage

(b) Raceway cover seal development

(c) Raceway cover overpressure test.

(d) Raceway beam dynamic tests.

The above programs are time phased to support the schedules for design and flight test. Development of the raceway cover seal and the dynamic investigation of equipment racks will be completed prior to the Critical Design Review.

1.2.3 R&D Instrumentation System

This phase of the test program will be conducted to verify the new cabling design and to operate MISEEL to provide a means of obtaining the experimental data required to complete the instrumentation system design and to verify its performance capabilities.

2.0 PROGRAM SUMMARY, EXPERIMENTAL TESTS

The following provides a brief summary of the experimental engineering tests supporting the design and development of the HSM 80C AVE. A general description of each of the test programs covered herein is presented in Paragraph 3.0 of this section.

2.1 Ordnance Joint and Skirt Panel Impulse Tests

2.1.1 Ordnance Joint Tests

A series of flat panels will be tested to appraise the Wing I ordnance joint concept for application on Wing VI interstages. In addition, full size circumferential staging joints will be fabricated and ordnance tested. The purpose will be to substantiate joint design and demonstrate compressive capability after severance. All specimens will be tested at ambient environmental conditions.

2.1.2 Skirt Panel Impulse Tests

The weight of the Stage 2 motor skirt panels on Wing VI will increase approximately 20 lbs. per panel over those used on Wing I. Four conical sections representing that portion of the 1-2 interstage forward of the stage separation plane will be fabricated and ordnance tested at ambient conditions. These tests will determine the impulse and trajectory of the panels resulting from detonation of the skirt removal ordnance. There are no conical section tests planned for the 2-3 interstage since that portion remaining on the stage 3 motor after staging is approximately the same as the Wing I configuration.

2.2 Ordnance and Interstage Environmental Vibration Tests

The change in the Wing VI stage 2 motor has resulted in changes to the 1-2 interstage configuration. The purpose of this test is to confirm the ability of the skirt removal ordnance, in the new interstage configuration, to withstand the dynamic environment of missile flight. It will be performed on the forward half of an operational 1-2 interstage.

2.3 Friction Joint Tests

Wing VI flights are expected to provide greater heat loading at the interface joints than have been encountered on Wings I thru V. This exceeds the range of existing data on the zinc

2.3 (Cont'd) chromate-carborundum friction joints at the interstage motor interfaces. A series of specimens will be fabricated and slip tested at elevated temperature to provide the additional range of joint capabilities required. These tests will determine aluminum to aluminum and titanium to aluminum friction joint characteristics with the zinc-chromate-carborundum finish.

2.4 Dynamic Investigation of Equipment Racks

A test will be conducted to investigate the dynamic response characteristics of the 2-3 interstage secondary structure and equipment. The test article will consist of experimental primary and secondary structures and simulated equipment representing the configuration presented at the applicable PDR's. Results of this testing will be used to provide an early appraisal of dynamic characteristics and to generate Flight Proof Test procedures.

2.5 Raceway Cover Overpressure Test

A test will be conducted to verify that the Wing VI raceway cover design will satisfactorily react to the Wing VI silo overpressure conditions. The test is also intended to verify the design of the raceway cover reinforcing edge adapter.

Test specimens will be made using production tooling. The test specimen will be tested at ambient environmental conditions.

2.6 Raceway Dynamic Tests

A G&C/CTL configuration of the interstage raceway disconnect beam will be tested. This configuration was chosen since it will produce the most severe loads during vibration and dynamic actuation tests. The purpose of the dynamic test is to verify the capability of the interstage raceway disconnect beam assembly to properly function during flight and staging environments.

2.7 Cable Design Experimental Tests

Static and elongation tests will be conducted on simulated R&D raceway wire bundles to verify the cabling design and to demonstrate that the cabling will withstand the flight environment.

2.8 External Insulation Subsystem Development Tests

Tests will be conducted to support the development of the external insulation subsystem. These tests are described in the following documents.

D2-30069 "External Insulation Sub-system Development Plan"

D2-30017 "Gas Dynamics Test Plan"

2.9 MISEEL (Minuteman Instrumentation Subsystem Engineering Evaluation Laboratory)

The Boeing Company will operate, modify and maintain a laboratory facility (MISEEL) which will satisfy requirements for test and development of the airborne instrumentation subsystem. This facility will be utilized on an "as-required" basis. The following tests are programmed to be conducted in MISEEL. Other tests will be conducted on an "as-required" basis.

2.9.1 PCM/FM Transducer Long Line Tests

Tests will be conducted to determine the effects of the increased lead lengths to the PCM/FM transducers resulting from relocating the PCM/FM Multiplexer components from the 1-2 interstage to the 2-3 interstage.

2.9.2 Airborne Instrumentation Integration Tests

An airborne instrumentation integration test will be conducted to verify the compatibility of the D20D, the SE144A, and the modified PCM/FM RF Section 43.

3.0 TEST DESCRIPTION

3.1 ORDNANCE JOINT AND SKIRT PANEL IMPULSE TESTS

The ordnance joints will be appraised in three parts. A series of flat panels (Part I) will be fired to evaluate the Wing I joint concept as applied to Wing VI dimensions and to appraise the modified longitudinal joint.

Part II will consist of firing one full size specimen of the 1-2 interstage separation ring to demonstrate design capabilities.

In part III, a series of four conical specimens representing the Stage II motor will be ordnance tested to determine impulse, panel trajectory and effect on structure.

3.1.1 Objectives

The objectives of this series of tests are as follows:

3.1.1.1 Part I

(a) To appraise Wing I skirt removal ordnance joint configuration for use on Wing VI interstages.

(b) To appraise the modified longitudinal skirt removal joint for use on both the 1-2 and 2-3 interstages.

(c) To demonstrate joint designs of the selected configurations for the circumferential and longitudinal ordnance joints in the 1-2 and 2-3 interstages.

(d) To determine relative pulse imparted to the forward circumferential joint panels when fired.

(e) To appraise the structural characteristics of the raceway staging plane seals.

3.1.1.2 Part II.

(a) To demonstrate operation of the final staging joint configuration for the 1-2 interstage and to verify that it will properly sever without excessive fragmentation and without cracking.

(b) To demonstrate that the staging joints will provide compressive load carrying capability under flight loads after severance.

3.1.1.3 Part III

(a) Determine the direction and magnitude of the impulse imparted to the skirt segments, by the ordnance blast, during skirt removal.

(b) Establish skirt removal time-trajectory predictions.

(c) Appraise skirt removal ordnance joints on the full scale basis.

3.1.2 Description

3.1.2.1 Part I, Flat Panels

Five specimens each (forty-five panels total) representative of the following ordnance joint configuration will be tested. (Longitudinal joints for both interstages are the same).

a. Interstage 1-2 forward circumferential.

b. Interstage 1-2 forward circumferential (2219-T6)

c. Interstage 1-2 longitudinal

d. Intersgate 1-2 longitudinal (2219-T6)

e. Interstage 1-2 longitudinal with cut back skin

f. Interstage 1-2 Stage Separation

g. Interstage 1-2 Stage Separation with raceway staging plane seal.

h. Interstage 2-3 Forward Circumferential

i. Interstage 2-3 Stage Separation

Material for the ordnance joint is 2014-T6 except as noted. These specimens will employ the same joint concepts used on Wing I missiles but will be fabricated to Wing VI dimensions. Each specimen will be fabricated by joining two 6" x 12" skin segments by an ordnance joint resulting in a flat 12" x 12" panel. Specification ordnance (12.5 ± .5 gr/ft) will be used. The panels will be uninsulated and will be fired at ambient environmental conditions. Impulse imparted to the forward circumferential joints will be determined by photographic means.

In addition to the forty-five panels described above, five similar panels representing the 1-2 longitudinal joint will be tested in static tension to failure.

3.1.2.2 Part II, Full Size Staging Joints

A section of 1-2 interstage having approximately 8 inches of skin on either side of the circumferential staging joint will be fabricated with the selected interstage joint design. This section will be subjected to the maximum anticipated compressive loads during staging and ordnance fired. After firing, the compressive load carrying capability will be demonstrated.

This specimen like those in Part I will be tested at ambient environmental conditions.

3.1.2.3 Part III, Skirt Panel Impulse

This series of tests will be conducted at ambient environmental conditions on a series of four conical sections representing that portion of the 1-2 interstage forward of the separation plane (Stage II motor skirt). Three of the specimens will be fabricated to obtain impulse and skirt panel trajectory as early in the program as possible. The remaining section will be fabricated to the final production configuration and will be tested to demonstrate final design, impulse and trajectory. All sections will be fabricated to represent the mass of the structure and insulation remaining at skirt removal. The specimens will be mounted vertically for test with the forward adapter ring restrained.

Rapid sequence stills or high speed motion pictures will be taken of each test to provide analytical data for determining impulse and trajectory. Each specimen will be examined visually to determine the affect of the ordnance impulse on the structure.

3.1.3 Documentation

Test Plan

Test plans will be informal and will be released prior to the firing of each test specimen. They shall contain the objectives, number of specimens, test requirements and applicable procedure and instructions.

Data Reports

Data Reports will be informal. They shall contain reference to the test plan and list any deviations or additions to requirements therein. They shall provide the significant results observed during or subsequent to the test of each specimen. These shall be released within 5 days after each test.

Final Report

A final report shall be prepared and formally released. It shall contain complete information covering test objectives, configuration, results and analysis.

3.2 ORDNANCE AND INTERSTAGE ENVIRONMENTAL VIBRATION TEST

Changes in the Wing VI Stage 2 motor have resulted in changes to the 1-2 interstage configuration. A test will be performed on the forward half of the 1-2 interstage to determine the ability of the skirt removal ordnance to withstand the missile dynamic environment.

3.2.1 Objective

The objective of this test is to confirm the ability of the skirt removal ordnance to withstand the dynamic environment of missile flight in the Wing VI 1-2 interstage configuration.

3.2.2 Description

The test will be performed on the forward half of an operational 1-2 interstage. The test specimen will be subjected to a series of sinusoidal sweeps in the longitudinal axis and both lateral axes without ordnance installed. Upon completion of this preliminary testing, the live ordnance will be installed. The specimen will be subjected to a programmed environment of complex shocks and random vibration, supplied on tape, simulating missile flight. This environment will be applied first to the two lateral axes and then to the longitudinal axis. After vibration testing is completes, the ordnance will be removed and visually inspected for damage. The ordnance will be then reassembled outside the interstage and fired.

3.2.3 Documentation

TEST PLAN

The test plan will be informal and will contain the objectives, configuration, requirements and applicable procedure and instructions.

DATA REPORTS

The data report will be informal. It will contain reference to the test plan and list any deviations or additions made during testing. It shall provide the significant results observed during or subsequent to the test.

FINAL REPORT

A final report shall be prepared and formally released. It shall contain complete information covering test objectives, configuration, results and analysis.

3.3 FRICTION JOINT TESTS

Wing VI joint interface temperatures will exceed Wing I - II temperatures. A series of tests will be conducted to determine Al/Al (Aluminum/Aluminum) and Al/Ti (Aluminum/Titanium) friction joint capabilities at elevated temperatures beyond the range of presently available data.

3.3.1 Objective

The objectives of this series of tests are:

a. To determine the capability of Al/Al joints to resist slip when heated to 300°F.

b. To determine the capability of Al/Ti joints to resist slip at 225°F and 300°F.

3.3.2 Description

The test specimens will be aluminum to aluminum and aluminum to titanium double lap joints. They will be fastened together in such a manner that the joint has to slip a small amount before any shear load is carried by the fasteners. The center member of the joint in all cases will be aluminum having a faying surface finish to zinc chromate primer with 20% carborundum additive.

The specimens will be bolted together (165 in.-lbs. torque) heated to the desired temperature, and located in tension. Load vs. deflection data will be recorded up to and including slip.

3.3.3 Documentation

TEST PLANS

Test plans will be informal and will outline test requirements for each group of specimens.

DATA REPORTS

Data reports will be informal. They will contain information concerning test objectives, conditions, configuration, and results.

FINAL REPORT

A final report will be written and formally released. It will contain test objectives, configuration, and results.

3.4 DYNAMIC INVESTIGATION OF EQUIPMENT RACKS

Dynamic investigation of the equipment racks will be performed by mounting them on an interstage similar to the final production article. Flight dynamic loads will be applied to the interstage and the vibration response of the secondary structure and equipment will be recorded.

3.4.1 Objectives

The objectives of this series of tests are:

a. To determine the dynamic characteristics of the secondary structures mounted within the 2-3 interstage.

b. To establish an dynamic loading procedure for Flight Proof Testing.

3.4.2 Description

The test article will be fabricated in the experimental shop due to the time limitation imposed by production tooling. R&D instrumentation components and operational equipment will be mass and shape simulated and mounted on the secondary structures. Design of the test specimen and its mounts will attempt to minimize deviations from missile configuration in the area of dynamic characteristics.

The specimen will be vibrated throughout a range from 5 cps to 2000 cps. The vibration input will be programmed, to give the expected peak response for each structural member. Vibration response of all secondary structures will be recorded.

3.4.3 Documentation

TEST PLAN

An informal test plan will be written and will stipulate test requirements and test date(s).

DATA REPORTS

Data reports of an informal nature, or a preliminary report will be written. These will show test objectives, results, and any recommendations for further testing.

FINAL REPORT

The final report will be documented. It shall contain test objectives, requirements description, results and analysis.

3.5 RACEWAY COVER OVERPRESSURE TESTS

3.5.1 Objectives

The objective of this test is to confirm that the raceway cover design is adequate to withstand the Wing VI silo overpressure requirements. This test is also to verify that the new raceway reinforcing edge adapter will not compromise the design which is based on existing Wing II hardware.

3.6.2 Description

The test specimen(s) will be fabricated using production drawings. Since cork insulation does not add strength to the cover, non-insulated test parts are planned. Where applicable, the raceway will contain foam. The cover to be tested will be of a maximum height configuration. The test shall be conducted at ambient environmental conditions.

3.5.3 Documentation

The following documentation will be used to satisfy the requirements of this section:

TEST PLANS

A formal test plan will be prepared. This plan will dictate test requirements such as instrumentation, loads and specimen configuration. This plan will also reflect the test schedule.

DATA REPORTS

Data reports will be prepared. These reports will list the objectives, results and any deviations from the test plan that were found necessary.

FINAL REPORT

A final report shall be prepared and formally released. It shall contain complete information covering test objectives, configuration, results and analyses.

3.6 RACEWAY DYNAMIC TESTS

3.6.1 Objectives

The objective of the dynamic test is to verify the capability of the interstage disconnect beam assembly to properly function during flight and staging conditions.

3.6.2 Description

The test article shall consist of a complete interstage raceway disconnect beam mounted on a 60° segment of the forward portion of Section 47 interstage structure. The raceway shall extend approximately 6" forward of the Stage II motor - Section 47 interstage structure interface and 10" aft of the separation plane. Raceway extensions are to be supported by test fixtures.

The CTL and G&C cable and staging connectors will be supplied with all pins wired in series.

For the vibration test, input and response data and electrical continuity will be recorded on FM tape. For the dynamic actuation test, the input and response of the beam assembly shall be reocrded on FM tape by means of accelerometers and strain gages and will also be reocrded on high speed film.

3.6.3 Documentation

TEST PLAN

A formal test plan will be written and documented. It will define all test requirements.

FINAL REPORT

A formal final report will be written and documented. It shall contain test objectives, requirements, description, results and analysis.

3.7 CABLE DESIGN EXPERIMENTAL TESTS

3.7.1 General

3.7.1.1 Static Tests: A series of six test specimens, two simulating 1st stage R&D raceway bundles and four simulating 2nd stage R&D raceway bundles; each having a thrust fitting potted to one end will be tested to determine effects of design temperature and vibration loading on the thrust fitting system.

3.7.1.2 Elongation Tests: Two preliminary test specimens simulating 3rd stage raceway bundles stranded around a soft center core will be tested to determine elongation vs. load characteristics.

Two test specimens simulating a 2nd stage raceway bundles and a 3rd stage raceway bundle, each stranded around a foam rubber core will be tested to determine elongation vs. load characteristics.

3.7.2 Objectives

3.7.2.1 Static Tests: The objectives of this series of tests are to:

Determine adequacy of the proposed thrust fitting system to support the raceway bundle under simulated maximum temperature and vibration level.

3.7.2.2 Elongation Tests: The objectives of this series of tests are to:

Determine if sufficient raceway bundle flexibility can be built into the raceway bundles to absorb the differences in length between supports due to manufacturing tolerances and engine expansion without imposing excessive loads on the supports.

3.7.3 Description

3.7.3.1 Static Tests: This series of tests will be conducted on simulated 1st and 2nd stage wire bundles. One specimen of each stage will have a single-hole thrust fitting potted to one end of the bundle and one specimen of each stage will have a divider in the thrust fitting dividing the fitting into two approximately equal areas (2nd stage) or two approximately equal areas) (1st stage) with the fitting potted to one end of the bundle. Each specimen will be mounted vertically and weights will be suspended from each wire to simulate the maximum load imposed by the combination of design acceleration and vibration levels. The thrust fitting temperature will be raised to the temperature specified by design criteria. Each specimen will be examined visually to determine any damage to the potting material or wire. Photographic coverage will be provided.

3.7.3.1 (continued)

Only wire which has met applicable dielectric strength specification shall be used in making up the bundles for the specimens described above. At the completion of each static test each wire will again be tested for dielectric strength and the data recorded.

3.7.3.2 Elongation Tests: This series of tests will be conducted at ambient temperature on four test specimens. Two preliminary specimens will be simulated 3rd stage wire bundles, stranded in a rope lay configuration around a sponge rubber core with a thrust fitting potted to each end. The bundle will be stretched between supports. Load vs. deflection data will be recorded.

One test specimen of a simulated 2nd stage bundle and one test specimen of a simulated 3rd stage bundle will be fabricated and tested as described above.

3.7.4 Documentation

TEST PLAN

An informal test plan will be prepared. This plan will dictate test requirements such as fixtures, loads and specimen configuration.

DATA REPORTS

Informal test reports will be prepared for each group of specimens tested under (1) static test, (2) elongation test, and (3) dielectric strength test.

FINAL REPORT

The final report will consist of a summary of results collected from the test reports from individual tests and conclusions.

3.8 EXTERNAL INSULATION SUBSYSTEM DEVELOPMENT TESTS

These test descriptions are not included in this document. Refer to Paragraph 2.9, Section A.

3.9 MISEEL

MISEEL is operated on a continuing "as required" basis to provide the experimental data needed to complete the subsystem design and to verify its performance capabilities.

Documentation

There will be no formal documentations prepared specifically for the test programs conducted in MISEEL. The test plans, test data, and test reports will be informal in nature and will be included in the MISEEL Test Document - D2-13493, Vol. III. This document is open-ended and is revised as required to reflect the results of MISEEL tests. A preliminary test plan is included in TEDS 31-71-148.

3.9.1 PCM/FM Transducer Long-Line Test

Tests will be conducted to determine the effects of the increased lead lengths between the transdcuers and multiplexer equipment for Stage I measurements.

3.9.1.1 Test Objectives

The objectives of this test program are:

1. To determine the PCM/FM data degradation due to the increased lead lengths resulting from relocating the multiplexer components from the 1-2 interstage to the 2-3 interstage.

2. To verify the PCM/FM Telemetry subsystem design implemented for the Wing VI measurements list.

3.9.1.2 Description

Representative data channels of each signal level (0-10mv, 0-50 mv, and 0-5 volts) will be tested in a Wing I - V configuration to determine a baseline of data quality. These representative data will then be "patched" through a simulated Wing VI, Section 47, wiring configuration and will be retested for a comparative evaluation of channel offset and noise. All testing will be done in MISEEL.

3.9.2 Airborne Instrumentation Integration Tests

3.9.2.1 Test Objectives

The objectives of this test program are to investigate the performance and subsystem effects of the D20D, the SE144 and the improved PCM/RF Section (10-20402-90) and to verify their system compatibility prior to their installation in GTM 060 at AMR and prior to the conducting of the FPT of Section 45 (Paragraph 3.5).

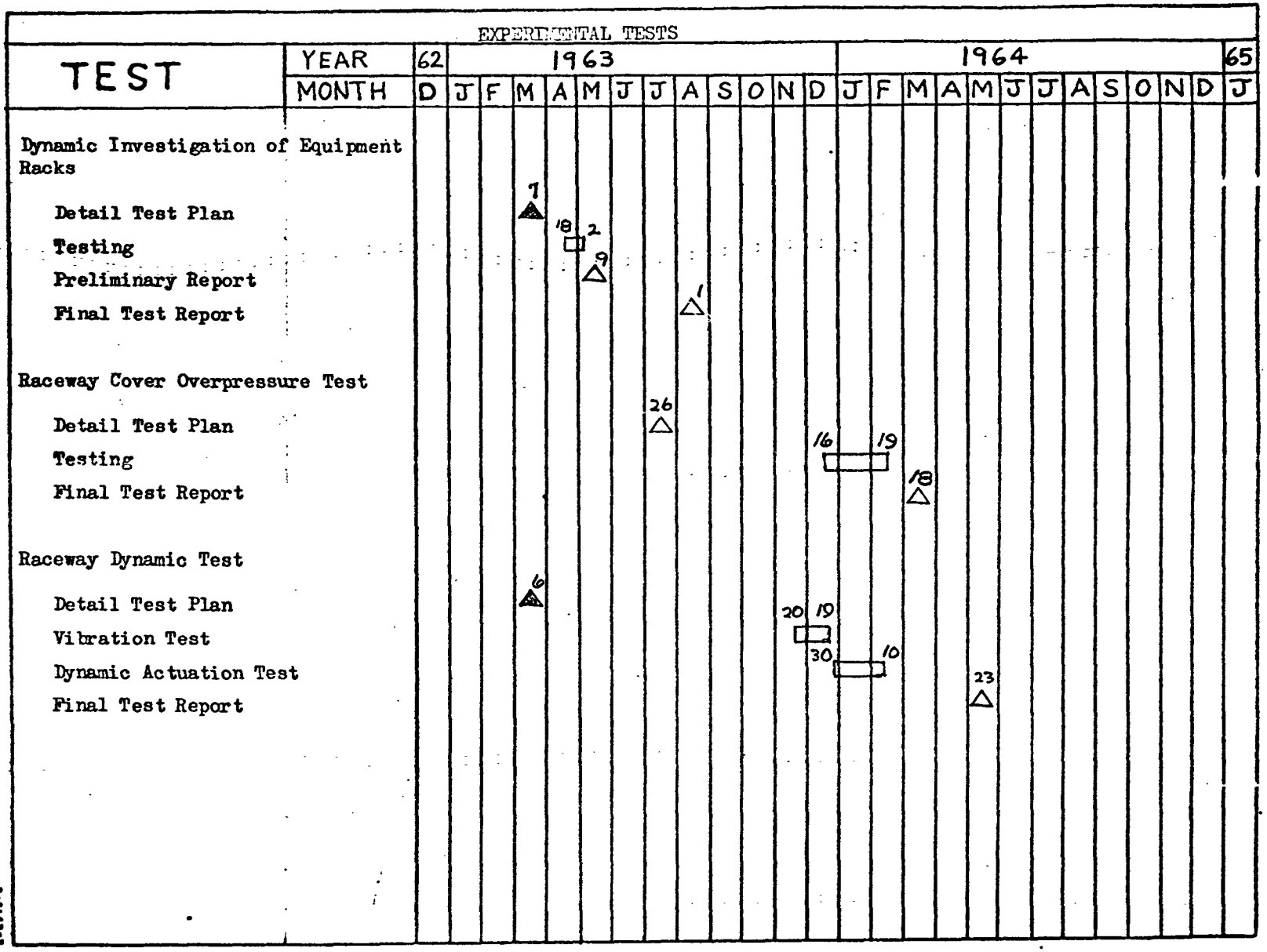
3.9.2.2 **Description**

Investigation of the performance characteristics of the D20D, SE144A, and the Improved PCM/FM RF Section (10-20402-90) shall consist of comparing the operation of these units against a baseline of their WS-133A counterparts (D20A, SE2A, and 10-20402-40 RF Section, respectively) in an operating subsystem, Each improved design unit will be substituted in turn for its WS-133A counterpart and its effect on subsystem operation noted. The improved PCM/FM RF Section will be checked for "deviation" and "power out" In addition, the three components will be operated as an integrated subsystem to verify their compatibility.

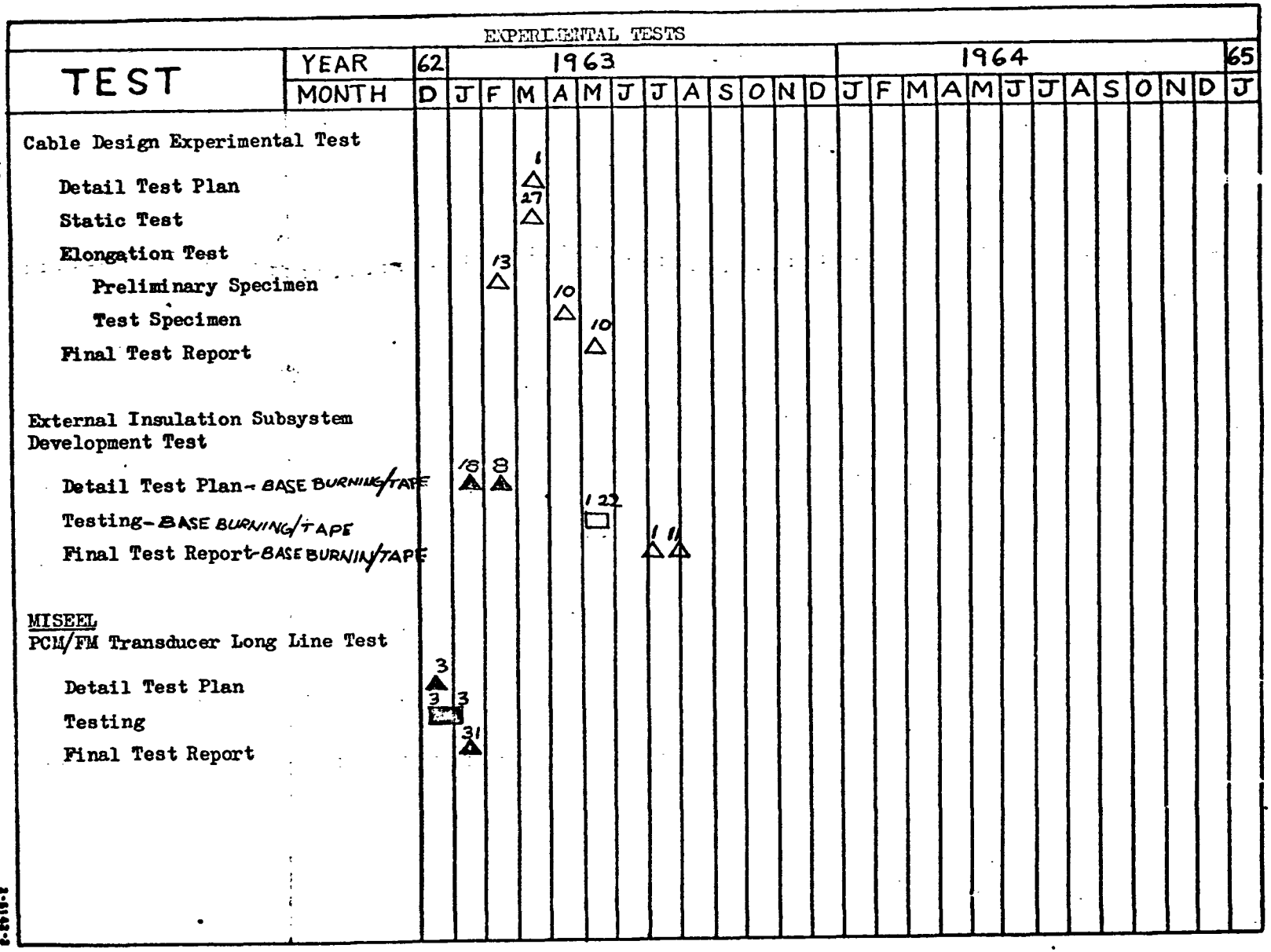
EXPERIMENTAL TESTS

TEST	YEAR	62	1963												1964												65
	MONTH	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J
Ordnance Joint & Skirt Panel Impulse Tests																											
Detail Test Plan			23 ▲																								
Test 1, 2, 3						19	16																				
Test 4													22	4													
Final Test Report															30 △												
Ordnance and Interstage Environmental Vibration Tests																											
Detail Test Plan										16 △																	
Testing																13	19										
Final Test Report																			22 △								
Friction Joint Test																											
Detail Test Plan																											
Testing																											
Final Test Report																											

EXPERIMENTAL TESTS



EXPERIMENTAL TESTS



US GPO 2000 REV. 8/62

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EXPERIMENTAL TESTS

TEST	YEAR	62	1963												1964												65
	MONTH	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J
Airborne Instrumentation Integration Tests																											
Detail Test Plan													25 △														
Testing														2 □	3 □												
Final Test Report															31 △												

US 4288 2000 REV. 8/63

3-8149-2

THE BOEING COMPANY

NUMBER D2-30070 MODEL NO. HSM 80C

TITLE ENGINEERING TEST PROGRAM PLAN FOR BOEING SUPPLIED AVE, HSM 80C - EVALUATION TESTS R

2-5142

SECTION TITLE PAGE U3 4288 0000 REV. 2/61

COMPILED BY	J. A. Albert	4-19-63
PREPARED BY	MISSILE SYSTEM PROJECT	
SUPERVISED BY	J. E. Whalen	4-19-63
APPROVED BY	J. A. Minshull	4-29-63
RELIABILITY APPROVAL		(DATE)

R R

AF 04(694)-266 CONTRACT NO.

CHARGE NUMBER

REV SYM B

1.0 INTRODUCTION EVALUATION TESTS

1.1 Purpose

The purpose of this section is to define the program plan for the HSM 80C AVE equipment evaluation tests as required by Task 5.3. of Exhibit B.

1.2 Scope

Evaluation tests will be performed to verify the adequacy of AVE design to meet the design criteria and to verify operation of each set of R&D flight test equipment.

1.2.1 Equipment Evaluation Tests

Tests will be conducted on two vendor-supplied components which have been changed from the design configuration used on the WS-133A R&D program. These tests will consist of the vendor qualification tests for the 10-20478 Thermocouple Reference Junction Assembly and the 10-20472 Evaluation Tests.

1.2.2 Specified Evaluation Tests

Evaluation tests specifically required by Task 5.3 of Exhibit B consist of Electro-Interference (E-I) Testing, Production Environmental Testing (PET) and Flight Proof Tests, (FPT) This document will describe in detail the program plan for FPT, but will only refer to other documentation which describes the program planning for E-I and PET testing.

2.0 PROGRAM SUMMARY, EVALUATION TESTS

The following provides a brief summary of the equipment evaluation tests supporting the design and development of the HSM 80C AVE. A general description of each of the test program covered herein is presented in Paragraph 3.0 of this section.

2.1 Equipment Evaluation Tests (Task 5.3.1 of Exhibit B)

2.1.1 Thermocouple Reference Junction Assembly (10-20478) Evaluation Tests (Vendor Qualification)

Qualification tests will be conducted by the vendor to demonstrate compliance of the Thermocouple Reference Junction Assembly (10-20478) located in Section 45 with the requirements of its specification. This testing is necessitated by the increased size and the addition of a connector in lieu of pigtails as compared to the assembly used in the WS-133A Program.

2.1.2 Interstage Connector (10-20472) Evaluation Tests (Vendor Qualification)

A qualification test program will be conducted on the 10-20472 Interstage Connector to demonstrate its compliance with the requirements of its specification. The test program is required due to the change in configuration to provide the capability of routing twelve thermocouple (12 chromel - 12 alumel pins) channels through the connector.

2.2 Electro-Interference Testing (Task 5.3.2 of Exhibit B)

2.2.1 Electro-Interference test descriptions will be presented in separate documentation. E-I test plans, as required by Tasks 5.3.2 and 7.2.2.10 of Exhibit B, will be prepared to define the test objectives, success criteria, test configuration, instrumentation, mode of operation, etc. D2-30154 will be prepared for WS-133B equipment level tests. D2-30155 and D2-30167 will serve as the test plans for AMR MIL-I-6051C testing. D2-30156 and D2-30168 will serve as the test plans for PMR MIL-I-6051C testing.

2.2.2 E-I testing on R&D AVE components will be limited to the E-I tests required for the vendor qualification of the Thermocouple Reference Junction Assembly (10-20748), paragraph 2.1 above.

2.3 Production Environmental Tests (PET) (Task 5.3.3 of Exhibit B)

PET will be conducted on each FTM AVE assembly containing instrumentation (Sections 43 and 45) as defined by S-133-1007D (D2-30058)

2.4 Flight Proof Tests (FPT) (Task 5.3.4 of Exhibit B)

Flight Proof Tests will be conducted on the R&D and operational equipment located within the 2-3 interstage for the purpose of demonstrating that the equipment will operate satisfactorily in the flight dynamic environment. Production equipment will be utilized.

3.0 TEST DESCRIPTIONS

3.1 EQUIPMENT EVALUATION TESTS

3.1.1 THERMOCOUPLE REFERENCE JUNCTION ASSEMBLY (10-20478) EVALUATION TESTS (VENDOR QUALIFICATION)

The assembly will be qualified to verify compliance with its specification and to demonstrate its ability to operate satisfactorily in the flight environment.

3.1.1.1 Test Objectives

The objectives of this test program are to:

1. Determine the dynamic characteristics of the assembly.
2. Insure proper resistance to humidity.
3. Insure adequate suppression of electro-interference.

3.1.1.2 Description

The tests will be conducted by the vendor on a production-type component to qualify the new design. Specifically, the component will be subjected to the following tests.

1. Vibration
2. Humidity
3. Electro-Interference (per GM-07-59-2617A)

Test Requirement	Frequency Range
B.1	D
D.4	G
D.7	I

3.1.1.3 Documentation

TEST PLAN

A formal test plan will be prepared by the vendor and submitted to The Boeing Company for approval. It will contain test objectives and requirements including test article description, instrumentation requirements and any other information pertinent to conducting the test.

3.1.1.3
(Cont'd) PROGRESS REPORT

Test progress reports or a preliminary test report will be prepared by the vendor and submitted to The Boeing Company. These will show test objectives, results and any recommendations for further testing.

FINAL REPORT

The final report will be prepared by the vendor at the conclusion of all testing and submitted to The Boeing Company for review and approval. The report will contain the test objectives, requirements, description, results and analysis.

3.1.2 INTERSTAGE CONNECTOR (10-20472) EVALUATION TESTS (VENDOR QUALIFICATION)

The new configuration of this connector will be qualified to verify compliance with its specification and to demonstrate its ability to operate satisfactorily in the flight environment.

3.1.2.1 Test Objectives

The objectives of this qualification test program are to:

1. Verify compliance of the connector with the requirements of its specification.

2. Demonstrate its ability to operate satisfactorily in the flight environment.

3.1.2.2 Description

The tests will be conducted by the vendor on a production-type component to qualify the new design. The test program will include the following types of tests: contact and insert retention, engaging & separation, high potential, moisture and corrosion resistance, insulation and contact resistance, circuit continuity, acceleration, shock and vibration, and thermal shock and thermal.

3.1.2.3 Documentation

TEST PLAN

A formal test plan will be prepared by the vendor and submitted to The Boeing Company for approval. It will contain test objectives and requirements including test article description, instrumentation requirements and any other information pertinent to conducting the test.

3.1.2.3
(Cont'd)

PROGRESS REPORT

Test progress reports or a preliminary test report will be prepared by the vendor and submitted to The Boeing Company. These will show test objectives, results and any recommendations for further testing.

FINAL REPORT

The final report will be prepared by the vendor at the conclusion of all testing and submitted to The Boeing Company for review and approval. This report will contain the test objectives, requirements, description, results and analysis.

3.2 ELECTRO-INTERFERENCE TESTING

E-I test descriptions are not to be presented in this document. Refer to paragraph 2.2 of Section B.

3.3 PRODUCTION ENVIRONMENTAL TEST (PET)

The PET description is not to be presented in this document. Refer to paragraph 2.3 of Section B.

3.4 FLIGHT PROOF TESTING

The R&D and G&C equipment mounted in the 2-3 interstage will be Flight Proof Tested in the flight dynamic environment.

3.4.1 OBJECTIVES

The objectives of this test are as follows:

a. To confirm dynamic integrity of the secondary structures under simulated flight dynamic loading conditions.

b. To confirm system capability of the R&D instrumentation components and operational equipment when subjected to simulated flight dynamic loading conditions.

Further objectives for flight proof testing of the subsystems within the 2-3 interstage will be outlined in the Detail Test Plan.

3.4.2 DESCRIPTION

The test article will be made on the FTM production line. Actual R&D instrumentation components will be used and the test article will be fully insulated. The test specimen and its mount will be designed to minimize deviations from missile configuration from the standpoint of dynamic characteristics.

3.4.2
(Cont'd) The specimens will be vibrated throughout a range from 5 cps to 2000 cps. The vibration input will be programmed to give the expected peak response for each structural member. Vibration response of all secondary structures as well as the primary structure will be recorded.

3.4.3 Documentation

TEST PLANS

A general test plan (TEDS 31-71-148) was incorporated into the WS-133B AMR Missile Components, Primary Structure and Raceways Preliminary Design Report and submitted to BSD by letter number 2-6450-02-195. Portions of the general test plan were included in the minutes of the WS-133B AV Secondary Structure and R&D Instrumentation Subsystem, PDR, Meeting No. APO 420, dated January 23 and 24, 1962.

A detailed test plan containing test objectives, acceptable performance criteria, instrumentation requirements, test article description, test methods and procedures and any other information pertinent to conducting the test will be released as Boeing document D2-30218. This test plan will be released initially without detailed test procedures to provide a test plan to support the R&D Instrumentation Subsystem CDR and will be revised to incorporate detail test procedures for conducting the test.

INTERIM REPORTS

Brief interim reports will be released just after completion of the PAT of the FPT Section and after completion of the FPT. These reports will present, in general, the results of testing as to the satisfactory achievement of each test objective and any recommendations deemed advisable.

FINAL REPORT

A final test report will be released as T2-3065 after a complete analysis of the test results. This report will contain a test description, test results, the analysis, and any recommendations.

EVALUATION TESTS

TEST	YEAR	62	1963												1964												65
	MONTH	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J
Thermocouple Reference Junction Assembly (Vendor Qualification)																											
Detail Test Plan						1																					
Testing								3	1																		
Final Test Report												7															
Interstage Connector (Vendor Qualification)																											
Detail Test Plan				6																							
Testing									3			3															
Final Test Report														13													
Flight Proof Test (FPT)																											
General Test Plan 11-28-2																											
Detail Test Plan (D2-30218)								28				18															
Testing															17		20										
Interim Test Reports																3		9									
Final Test Report																				25							
Electro-Interference Testing																											
MIL-I-6051C																											
Test Plan Release																		4									
Test Complete																			20								

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2-5143-2

THE BOEING COMPANY

NUMBER D2-30070 MODEL NO. HSM 80C

TITLE ENGINEERING TEST PROGRAM PLAN FOR BOEING SUPPLIED AVE. HSM 80C - SPECIAL TESTS

R

2-5142

COMPILED BY J. A. Albert 4-19-63
J. A. Albert

PREPARED BY MISSILE SYSTEM PROJECT

SUPERVISED BY J. E. Whalen 4-19-63
J. E. Whalen

APPROVED BY J. A. Minshull 4-9-63
J. A. Minshull

RELIABILITY APPROVAL (DATE)

R

R

SECTION TITLE PAGE U3 4238 0000 REV. 2/61

AF 04(694)-266
CONTRACT NO.

CHARGE NUMBER

REV SYM B

VOL.
SEC. C

NO. D2-30070
PAGE 1 OF 8

1.0 INTRODUCTION, SPECIAL TESTS

1.1 Purpose

The purpose of this section is to define the program plan for the HSM 80C AVE special tests as required by Task 5.4 of Exhibit B.

1.2 Scope

The tests specifically required by Task 5.4 are:

1. Gas Dynamic Tests
2. Staging Tests
3. Static AVE Test Program

The Gas Dynamic Test program is presented in general, with reference to the detailed test program plan.

The Combined Staging and Skirt Removal tests and the Static tests are described in detail. The purpose of these tests is to evaluate and determine the staging characteristics, evaluate the capability of equipment to survive the staging environment and to demonstrate the structural capability of the AVE items which have been significantly changed due to the Wing VI block change.

2.0 PROGRAM SUMMARY, SPECIAL TESTS

The following provides a brief summary of the special tests supporting the design and development of the HSM 80C AVE. A general description of each of the test programs covered herein is presented in Paragraph 3.0 of this Section.

2.1 Gas Dynamics Tests (Special Test per Task 5.4.1 of Exhibit B)

Adequate gas dynamics design criteria such as aerodynamic forces, moments and pressures must be obtained for the missile during launch and boost. These data will be used to determine stability of the missile in the silo and the missile launch trajectory, and to perform missile stability and drag analyses and aerodynamic heating and loads analyses. Acquisition of these data will be by the conducting of missile-silo force, moment and pressure tests of subscale models. In addition to conducting these tests, Boeing will prepare the test plans, design and construct the necessary models, and reduce and analyze test data. Boeing will procure and perform pre- and post- test calibration on Hy-Cal Calorimeters and monitor special radiation measurements. When the Naval Ordnance Laboratory hypersonic wind tunnel facility is used, Boeing will assist in conducting the tests.

2.1 (Cont'd) Tests will also be conducted to determine the effects of the second stage roll control jets on missile stability and control, and on thermal environment. These tests will require the preparation of a test plan, designs and construction of test hardware (except for the roll control system which will be GFE) and acquisition, reduction, and analysis of test data.

Aerojet will conduct 37-inch motor tests in an AEDC altitude chamber facility to provide detailed heating data for the second stage base region, and base area insulation materials properties data. These tests will require Boeing assistance in the definition of instrumentation requirements, monitoring of tests, and analysis of thermal environmental data. Test instrumentation specimens to be supplied to AEDC will be prepared and instrumented by Boeing.

2.2 Combined Staging and Skirt Removal Tests (Special Test Per Task 5.4.2 of Exhibit B)

Full-scale combined staging and skirt removal tests will be conducted on the 1-2 and 2-3 interstages with support from the Associate Contractors. There will be one test set-up for each interstage. In addition, one 2-3 interstage and two 1-2 interstage set-ups will be provided for backup. All will be of the R&D configuration. Each set-up will consist of a dummy leaving stage, a production interstage and a live stage 2 or stage 3 motor as applicable. These are integrated sub-systems tests which will satisfy objectives from the motor and guidance contractors as well as Boeing. Primary Boeing objectives are to demonstrate function of Boeing supplied hardware and to obtain environmental data during staging and skirt removal. A formal detail test plan will be originated by Boeing and coordinated with the affected Associate Contractors for both tests.

2.3 Static Tests (Special Test per Task 5.4.5 of Exhibit B)

Static test specimens will be fabricated on production tooling for the stage 1 skirt, 1-2 interstage and 2-3 interstage. These specimens will not be insulated. They will be subjected to static test loading to demonstrate design capability of the sections to satisfy Wing VI load requirements. A formal detail test plan will be prepared for these tests.

3.0 TEST DESCRIPTIONS

3.1 GAS DYNAMICS TESTS

The test description of these tests is presented in D2-30017, "Gas Dynamics Test Plan"

3.2 STAGING AND SKIRT REMOVAL TESTS

Stage separation and skirt removal will be demonstrated by live motor firings at the Stage II and Stage III Associate Contractors (AGC and HPC respectively). Two 2-3 interstage and three 1-2 interstage test assemblies of Boeing supplied hardware are programmed for test support. Each staging test shall be entered in the milestone charts of each affected associate contributing hardware or services for the test.

3.2.1 Objectives

The following are Boeing objectives for this series of tests. Additional objectives will be presented by the affected Associate Contractors and will be included in a formal "Detail Test Plan" to be written by Boeing.

a. To demonstrate operation of the staging and skirt removal system in the R&D configuration.

b. To obtain environmental data under staging and skirt removal conditions.

c. To demonstrate operation of all equipment associated with staging and skirt removal. This includes control systems, wiring disconnects, destruct system, the motor and the ordnance system itself.

3.2.2 Description

Hardware for each test will consist of an interstage, a live motor forward of the interstage, a dummy motor aft of the interstage, and R&D equipment. All Boeing test articles will be of R&D configuration. One 2-3 interstage set-up is scheduled for test and one for backup. One 1-2 interstage set-up is scheduled for test and two for backup.

3.2.2.1 The live motors will be supplied by the affected Associate Contractors. Stage II motors will have operable LITVC (Liquid Injection Thrust Vector Control). Stage III motors will have operable Nozzle Control Units.

3.2.2.2 Interstages will be supplied by Boeing and will be made on production line tools. Insulation representative of that remaining at skirt removal will be applied. The test articles will be mounted horizontally and will be oriented with the longitudinal separation joints at 0°, 90°, 180°, and 270° with respect to ground to facilitate skirt panel ejection. All tests will utilize production interstages.

3.2.2.3 Dummy motors will be built by Boeing. Their mass will be sufficient to simulate tail off thrust. Actual forward domes will be used for fabrication of these items. The domes will be supplied by the affected Associate Contractors as Government Furnished Equipment.

3.2.2.4 Motor contractor personnel will instrument the test articles and assemble them in a test bay at their facilities. Representatives from Boeing, Autonetics, and STL will provide engineering assistance during the test buildup as needed, approve the final test articles, witness the test firings, and participate in post test meetings.

3.2.3 Documentation

TEST PLANS

The Boeing Company will prepare formal test plans. They will include: test objectives, responsibilities, and configuration; facility and instrumentation requirements; an assembly procedure and assembly check-list; and a prefire checklist for Boeing functions.

Strict configuration control and documentation shall be maintained for all tests on both instrumentation and test equipment. The documentation for this control shall be the detail test plan provided by Boeing and coordinated with all affected associates in coordination meetings chaired by STL.

These plans will be updated prior to each test to reflect current plans and configuration.

TEST PROCEDURES

The motor contractors will prepare test procedures for each test. They shall include reference to general steps from the Boeing assembly procedure plus all important check-off functions for Associate Contractor supplied equipment during

3.2.3
(Cont'd)

assembly, checkout, and countdown. These test procedures will serve as the official record for Associate Contractor acceptance of pre-test events.

DATA REPORTS

The motor contractors will send copies of the data to Boeing and STL. Boeing will prepare data reports which will be formally released.

FINAL REPORTS

After completion of all testing of each interstage, Boeing will prepare a final report. These reports shall include objectives, test requirements, instrumentation lists, test photos, results and analysis.

Each participating associate will prepare a final analysis report covering their hardware, objectives and performance as called out in the detail test plan. These individual reports will be submitted to BSD/STL with copies to Boeing for inclusion in the final staging test report.

3.3 STATIC TESTS

Sections 45, 47 and 49 will be tested to verify structural integrity under flight load, heating and silo overpressure load conditions.

3.3.1 Test Objectives

The objectives will be specifically as follows:

a. To verify the static integrity and determine the strength capability of Sections 45, 47 and 49.

b. To determine stress and load distribution under flight and silo overpressure loading conditions.

3.3.2 Description

Both interstages and the Stage I skirt will be manufactured on production line tools. The specimens will be uninsulated but will be provided with raceway structural components including covers.

Tests will be conducted in the Boeing Developmental Center Structures Laboratories. Compressive loads will be applied hydraulically through the interfaces. Silo overpressure will be simulated by water pressure.

3.3.3 Documentation

TEST PLAN

A formal test plan will be prepared. This plan will dictate test requirements such as instrumentation, loads and specimen configuration. This plan will also reflect the test schedule.

DATA REPORTS

Separate data reports will be prepared for each specimen tested. These reports will list the objectives, results and any deviations from the test plan that were found necessary.

FINAL REPORT

A final report covering missile Sections 45, 47 and 49 will be prepared and formally released. It shall contain test objectives, configuration, photos of test specimens and test setup as well as instrumentation used, results obtained and analysis.

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SPECIAL TESTS

TEST	YEAR	62	1963												1964												65
	MONTH	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J
Gas Dynamic Test																											
Combined Staging & Skirt Removal Tests																											
Preliminary Test Plan					28 ▲																						
Detail Test Plan							2 △																				
Staging I - II - HPC - Test																	3 △										
Staging II - III - AGC - Test																7 △											
Final Test Report - HPC																				16 △							
Final Test Report - AGC																				2 △							
Static Test																											
Preliminary Test Plan							6 △																				
Detail Test Plan								26 △																			
Testing														16	19												
Final Test Report																			18 △								

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